15596 PORPHYRITIC SPHERULITIC QUARTZ-NORMATIVE MARE BASALT ST. 9A 224.8 g

INTRODUCTION: 15596 is a porphyritic mare basalt with conspicuously irregularly distributed vugs (Fig. 1). Large pigeonite phenocrysts are set in a spherulitic groundmass. Both phenocrysts and groundmass are coarser-grained than in 15595, chipped from the same boulder. Its chemistry is typical of Apollo 15 quartz-normative mare basalts. The sample is medium olive gray, blocky, angular, and tough. The broken surface is rough, the others irregular with many zap pits. The vugs make up about 15% of the fresh surface. The pigeonites have yellow-green cores and dark brown rims.

15596 was chipped, with 15595, from a 2 m x 50 cm boulder about 8 m east of the rim of Hadley Rille (See Fig. 15595-2).

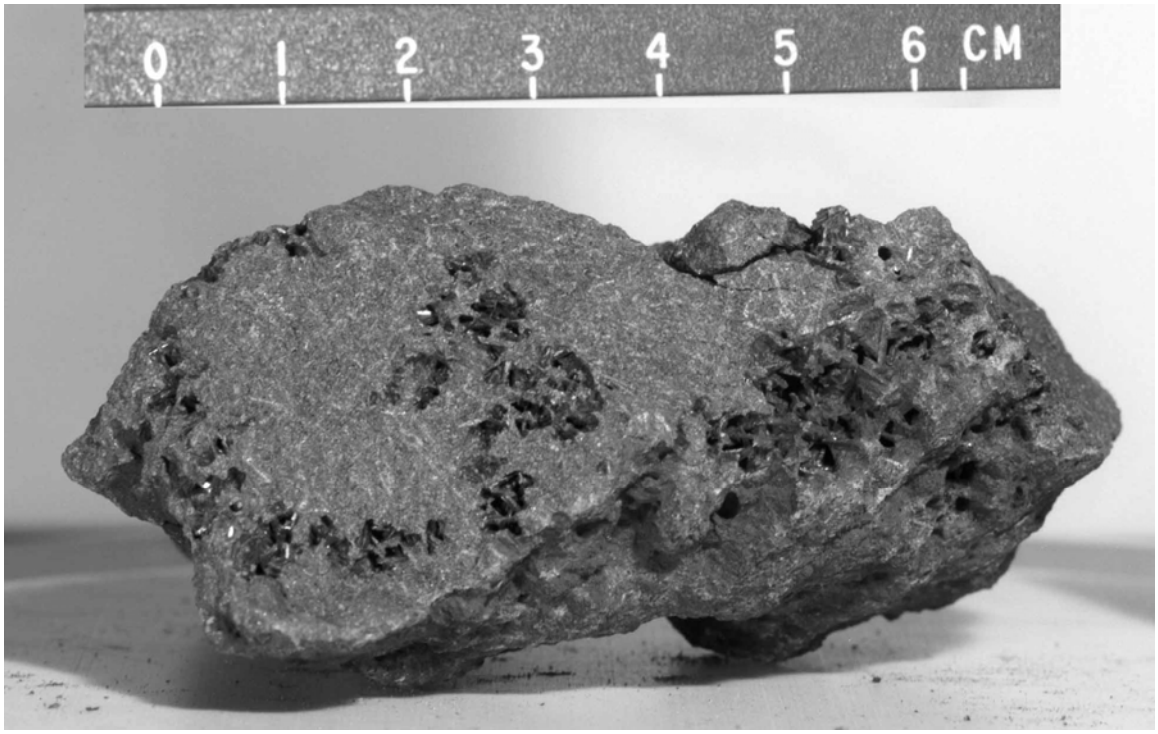


Figure 1. Broken face of 15596. S-71-46811

PETROLOGY: 15596 consists of large pigeonite phenocrysts in a fan spherulitic groundmass of plagioclase, pyroxene, and opaque minerals (Fig. 2). The pigeonites are commonly 6 or 7 mm long in thin sections. Some are twinned, and several are hollow (filled with spherulitic groundmass). They are zoned, with sharply bounded rims of augite. The groundmass contains opaque minerals and vugs. Brown et al. (1972) gave a mode with 41% phenocrysts, and a groundmass comprising 32% clinopyroxene, 20% plagioclase ($An_{83-87}$), and 6% opaque minerals. They also observed rare zoned olivines ($Fo_{66-37}$), and Cr-spinel microphenocrysts. Grove and Walker (1977) reported a mode of 40.9% phenocrysts, 58.9% groundmass, and 0.2% opaques (not including those in the groundmass). Brown et al. (1972) reported that the zoned Mg-pigeonite cores have Al:Ti of 7 to 10 and the augite mantles have Al:Ti of 5 to 7. The groundmass pyroxenes have a chemistry discontinuous with the mantles and approach pyroxferroite in composition. Engelhardt (1979) noted that ilmenite crystallization started after plagioclase crystallization started, and ended before pyroxene crystallization ended.

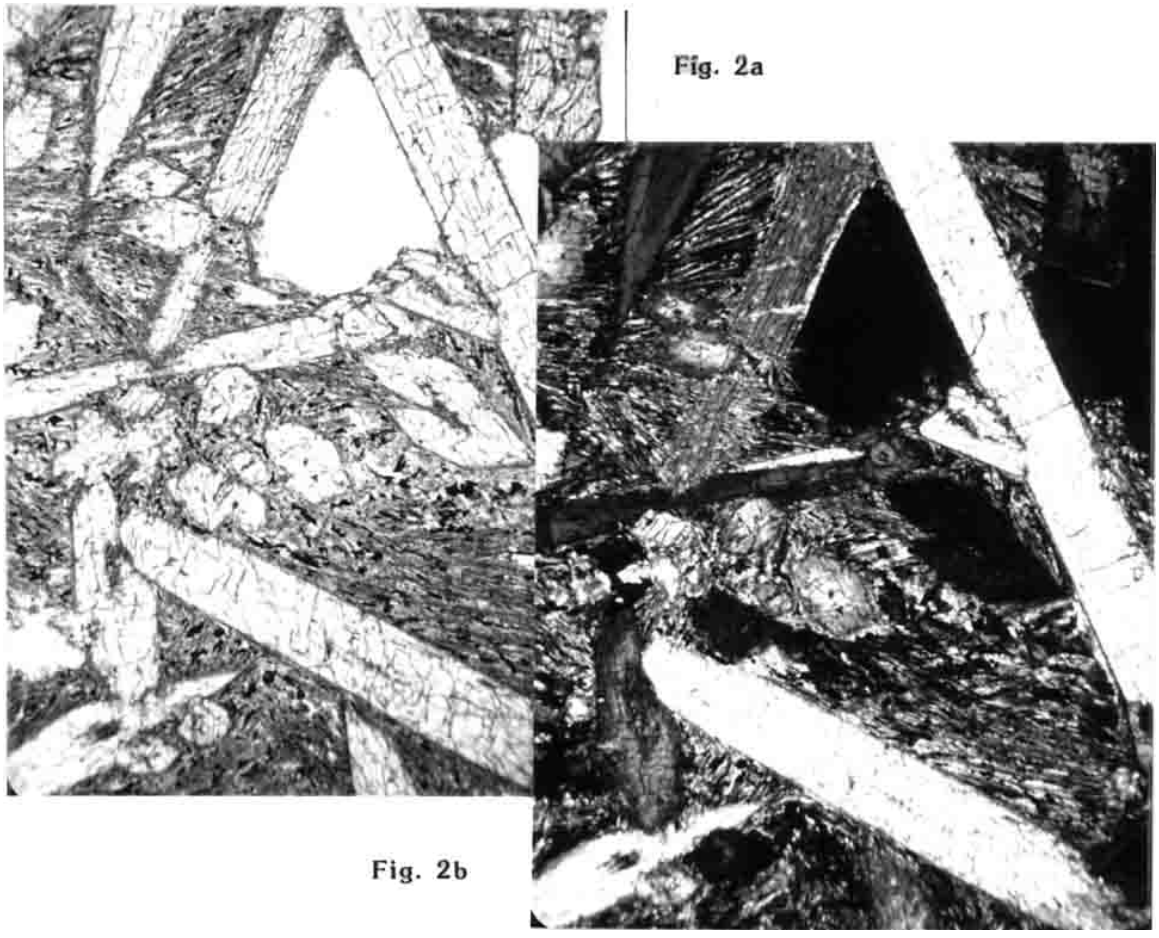


Figure 2. Photomicrographs of 15596,12, showing pigeonite phenocrysts with their augite rims, hollow cross-sections, vug, and spherulitic groundmass containing opaques. Widths about 3 mm. a) transmitted light; b) crossed polarizers.

Cooling history: Lofgren et al. (1975), in a comparison of natural textures with those produced in dynamic crystallization experiments (known linear cooling rates) deduced a cooling rate of 2 to 5°C/hr for the phenocrysts, within the same range as 15595 but actually slower, and 10 to 30°C/hr for the groundmass, and also slower than 15595. In a similar but more sophisticated study, Grove and Walker (1977) inferred an early crystallization rate of 3.75°C/hr from the pyroxene nucleation density, a integrated rate of 1.75°C/hr from the total pyroxene phenocryst size, and a late-stage rate of 13°C/hr from the plagioclase sizes. They inferred final crystallization about 24 cm from a conductive boundary.

CHEMISTRY: Rhodes and Blanchard (1983) reported that they had made a major and trace element analysis of a 2 g sample of bulk rock which is similar to that of average Apollo 15 quartz-normative mare basalts.

PHYSICAL PROPERTIES: Gose et al. (1972) and Pearce et al. (1973) reported on natural remanent magnetic intensity and direction for the bulk rock. The intensity was $6.4 \times 10^{-6}$ emu/g, and the direction differs from those of 15595 splits, chips from the same boulder (see Fig. 15595-6). Hence the NRM is probably not of lunar origin.

PROCESSING AND SUBDIVISIONS: Chip ,1 was taken from the "S-B" edge, made into a potted butt, and partly used to make thin sections ,12 through ,16. A small chip ,2 was removed at the same time. In 1982, further chipping produced samples for the chemical analysis. ,0 is now 213.9 g.